STRATEGY FOR RECOVERY

A core area represents the closest approximation of a biologically functioning unit. The combination of core habitat (*i.e.*, habitat that could supply all the necessary elements for the long-term security of bull trout including both spawning and rearing as well as foraging, migrating, and overwintering) and a core population (*i.e.*, bull trout inhabiting a core habitat) constitutes the basic core area upon which to gauge recovery within a recovery unit. Within a core area, many local populations may exist.

The extent of historic and current migratory connectivity, with consideration of natural and man-made barriers, survey and movement data, and genetic analysis need to be considered when defining core areas. Except where supported by biological or geographic evidence, core areas are considered to be distinct and their boundaries do not overlap. Current distribution of bull trout in the Yakima River basin is fragmented and bull trout exist in three primary areas. Bull trout are found in the Naches River drainage, upper Yakima River drainage (above the confluence with the Naches), and the Ahtanum Creek drainage. Of the five extant adfluvial populations within the basin, only bull trout in Rimrock Lake did not originate from a native adfluvial form. Fluvial bull trout in Rimrock Lake adopted a adfluvial life history form subsequent to impoundment. Little information exists on historic distribution of migratory bull trout, the current use of the mainstem Yakima by fluvial bull trout, and migration of bull trout from the Yakima River basin to the Columbia River.

Genetic differences among fragmented groups of bull trout in the Yakima River basin is unknown. However, differences in spawn timing between bull trout in the Naches River and the upper Yakima River have been noted (Anderson, E. *pers. comm*. 2001b). Similar differences in spawning time has been found for anadromous salmon and steelhead in the same geographic areas. Additional genetic information is needed in order to validate the separation of bull trout within the Middle Columbia Recovery Unit.

It is likely that historic distribution of bull trout was more expansive than currently observed. Migratory life-history strategies of bull trout probably used the mainstem Yakima River for feeding and overwintering. Isolation and fragmentation of bull trout by dams, irrigation withdrawals, and poor habitat conditions were identified as limiting factors in the Middle Columbia Recovery Unit. Reducing these threats, and re-establishing connectivity within the basin has been deemed essential for recovery.

For purposes of recovery, the Middle Columbia Recovery Unit recovery unit has a single core area encompassing tributaries containing local populations (both current or potential as identified by the recovery unit team) and the mainstem Yakima River down to the confluence with the Columbia River. The mainstem Columbia River is not considered part of the core area, but is identified as a primary research need. Collection of additional information regarding the separation of bull trout within the Yakima basin, as well as the current, or potential use of the mainstem Columbia River may revise this classification.

Recovery Goals and Objectives

The ultimate goal of the draft bull trout recovery plan is to **ensure the long-term persistence of self-sustaining, complex interacting groups of bull trout distributed across the species native range, so the species can be delisted.** To achieve this goal the following objectives have been identified for bull trout in the Middle Columbia Recovery Unit:

5) Maintain current distribution of bull trout and restore distribution in previously occupied areas within the Middle Columbia Recovery Unit.

6) Maintain stable or increasing trends in abundance of bull trout.

7) Restore and maintain suitable habitat conditions for all bull trout life history stages and strategies.

8) Conserve genetic diversity and provide opportunity for genetic exchange.

Rieman and McIntyre (1993) and Rieman and Allendorf (2001) evaluated the bull trout population numbers and habitat thresholds necessary for long-term viability of the species. They identified four elements, and the characteristics of those elements, to consider when evaluating the viability of bull trout populations. These four elements are 1) number of local populations; 2) adult abundance (defined as the number of spawning fish present in a core area in a given year); 3) productivity, or the reproductive rate of the population (as measured by population trend and variability); and 4) connectivity (as represented by the migratory life history form and functional habitat). For each element, the Middle Columbia Recovery Unit Team classified bull trout into relative risk categories based on the best available data and the professional judgment of the team.

The Middle Columbia Recovery Unit Team also evaluated each element under a potential recovered condition to produce recovery criteria. Evaluation of these elements under a recovered condition assumed that actions identified within this chapter had been implemented. Recovery criteria for the Middle Columbia Recovery Unit reflect 1) the stated objectives for the recovery unit, 2) evaluation of each population element in both current and recovered conditions, and 3) consideration of current and recovered habitat characteristics within the recovery unit. Recovery criteria will probably be revised in the future as more detailed information on bull trout population dynamics becomes available. Given the limited information on bull trout, both the level of adult abundance and the number of local populations needed to lessen the risk of extinction should be viewed as a best estimate.

This approach to developing recovery criteria acknowledges that the status of populations in some core areas may remain short of ideals described by conservation biology theory. Some core areas may be limited by natural attributes or by patch size and may always remain at a relatively high risk of extinction. Because of limited data within the Middle Columbia Recovery Unit, the recovery unit team relied heavily on the professional judgment of its members.

Local Populations

Metapopulation theory is important to consider in bull trout recovery. A metapopulation is an interacting network of local populations with varying frequencies of migration and gene flow among them (Meffe and Carroll 1994) (Chapter 1). Multiple local populations distributed and interconnected throughout a watershed provide a mechanism for spreading risk from stochastic events. In part, distribution of local populations in such a manner is an indicator of a functioning core area. Based in part on guidance from Rieman and McIntyre (1993), bull trout core areas with fewer than 5 local populations are at increased risk, core areas with between 5 and 10 local populations are at intermediate risk, and core areas with more than 10 interconnected local populations are at diminished risk.

Current local populations in the Yakima Core Area include: Ahtanum (including North, South, and Middle forks), Upper Yakima mainstem (Keechelus to Easton), Rattlesnake Creek, North Fork Teanaway River, Upper Cle Elum River, American River, Crow Creek, South Fork Tieton River, Indian Creek, Deep Creek, Box Canyon Creek, Upper Kachess River (including Mineral Creek), and Gold Creek. Based on the above guidance, and if all local populations were interconnected, bull trout in the Middle Columbia Recovery Unit would currently be at diminished risk. Resident bull trout are known to occur within the recovery unit. However, an accurate description of their current distribution is unknown, and the identification of resident local populations is considered a research need.

Adult Abundance

The recovered abundance levels in the Middle Columbia Recovery Unit were evaluated by considering theoretical estimates of effective population size, historic census information, and the professional judgement of recovery team members. In general, effective population size is a theoretical concept that allows one to predict potential future losses of genetic variation within a population, due to small population sizes and genetic drift (Chapter 1). For the purpose of recovery planning, effective population size is the number of adult bull trout that successfully spawn annually. Based on standardized theoretical equations (Crow and Kimura 1970), guidelines have been established for maintaining minimum

effective population sizes for conservation purposes. Effective population sizes greater than 50 adults are necessary to prevent inbreeding depression and a potential decrease in viability or reproductive fitness of a population (Franklin 1980). In order to minimize the loss of genetic variation due to genetic drift, and maintain constant genetic variance within a population, an effective population size of at least 500 is recommended (Franklin 1980; Soule 1980; Lande 1988). Effective population sizes required to maintain long-term genetic variation that can serve as a reservoir for future adaptations in response to natural selection and changing environmental conditions are discussed in Chapter 1 of the recovery plan.

For bull trout, Rieman and Allendorf (2001) estimated that a minimum census number of 50 to 100 spawners per year was needed to minimize potential inbreeding effects within local populations. Furthermore, a census population size between 500 and 1,000 adults in a core area is needed to minimize the deleterious effects of genetic variation due to drift.

For the purposes of bull trout recovery planning, abundance levels were conservatively evaluated at the local population and core area levels. Local populations which contained less than 100 censussed spawning adults per year were classified at risk from inbreeding depression. Bull trout core areas which contained less that 1,000 censussed spawning adults per year were classified as at risk from genetic drift.

Overall, bull trout in the Middle Columbia Recovery Unit persist at low numbers in fragmented local populations. The strongest bull trout populations are represented by the local populations in the South Fork Tieton River and Indian Creek. Average redd count estimates since 1996 in the South Fork Tieton River and Indian Creek are 169 and 191, respectively. Conservative adult population estimates (2 fish per redd) would result in 338 adults in the South Fork Tieton, and 382 adults in Indian Creek. The local population in Deep Creek has been more variable than either the South Fork Tieton River or Indian Creek and has averaged over the same time period 96 redds, or 192 adults. Adult redd surveys conducted over the same time period conservatively estimate that bull trout in

Gold (64 adults), Box Canyon (26 adults), and Ahtanum (18 adults) creeks are at very low abundance. Similarly, bull trout in the American River (64 adults) and in Rattlesnake Creek (94 adults) are also at low abundance. Estimates of adult abundance in other local populations within the core area including the upper Yakima mainstem (Keechelus to Easton) River, Crow Creek, North Fork Teanaway River, upper Kachess River, and the upper Cle Elum River are unknown due to the short time span of redd surveys. Based on the aforementioned abundance guidance, bull trout in the South Fork Tieton, Indian Creek, and Deep Creek local populations were not considered at risk from inbreeding depression. Other local populations were either at risk due to low abundance levels, or classified as unknown due to a lack of information. If all local populations in the Yakima Core Area were interconnected, bull trout would currently not be at intermediate risk from the deleterious effects of genetic drift.

Estimated abundance of bull trout among all local populations in the Yakima Core area is between 2,550 to 3050 migratory adults. The recovered abundance criteria was derived using the professional judgement of the Middle Columbia Recovery Unit Team to estimate the productive capacity of identified local populations. Adult abundance estimates for individual local populations are: Gold Creek (200 adults); Box Canyon Creek (100 adults); Upper Kachess River (100 adults); Indian Creek (500 adults); South Fork Tieton River (500 adults); Deep Creek (300 adults); American River including Union and Kettle creeks (200 to 500 adults); Rattlesnake Creek including Little Wildcat Creek (200 to 400 adults); Crow Creek (150 adults); Ahtanum Creek including the North, South, and Middle forks (300 adults). Recovered abundance levels in the aforementioned local populations should prevent inbreeding depression. Recovered abundance levels do not include estimates for local populations in the Upper Yakima River mainstem (Keechelus to Easton), North Fork Teanaway River, Middle Fork Teanaway River, North Fork Tieton River, Taneum Creek, and the Upper Cle Elum River and consequently inbreeding risk was not evaluated. Estimates for these six migratory local populations, as well as the resident life history component, are considered research needs. The established recovered abundance levels assume that threats (including fragmentation of local populations) have been addressed and that the Yakima Core Area is a functioning

metapopulation. While the recovered abundance for the Yakima Core Area falls short of long-term idealized estimates for effective population size (Chapter 1), the Middle Columbia Recovery Team feels that the estimated range accurately reflects an achievable recovered abundance level. The identified recovered abundance levels should minimize the loss of genetic variation due to drift. The U.S. Fish and Wildlife Service will evaluate the identified abundance levels relative to the maintenance of long-term genetic variation which would provide the population the ability to adapt to natural selection and changing environmental conditions.

Productivity

A stable or increasing population is a key criterion for recovery under the requirements of the Endangered Species Act. Measures of the trend of a population (the tendency to increase, decrease, or remain stable) include population growth rate or productivity. Estimates of population growth rate (*i.e.*, productivity over the entire life cycle) that indicate a population is consistently failing to replace itself, indicate increased extinction risk. Therefore, the reproductive rate should indicate the population is replacing itself, or growing.

Since estimates of the total population size are rarely available, the productivity or population growth rate is usually estimated from temporal trends in indices of abundance at a particular life stage. For example, redd counts are often used as an index of a spawning adult population. The direction and magnitude of a trend in the index can be used as a surrogate for the growth rate of the entire population. For instance, a downward trend in an abundance indicator may signal the need for increased protection, regardless of the actual size of the population. A population which is below recovered abundance levels but moving toward recovery would be expected to exhibit an increasing trend in the indicator.

The population growth rate is an indicator of extinction probability. The probability of going extinct cannot be measured directly; it can, however, be estimated as the consequence of the population growth rate and the variability in that rate. For a population to be considered viable, its natural productivity should

be sufficient to replace itself from generation to generation. Evaluations of population status will also have to take into account uncertainty in estimates of population growth rate or productivity. The growth rate must indicate a stable or increasing population for a period of time for the population to contribute to recovery. Given the overall lack of long-term population census information in the Yakima Core Area bull trout in the Middle Columbia Recovery Unit are currently at increased risk of extinction.

Connectivity

The presence of the migratory life history form within the Middle Columbia Recovery Unit was used as an indicator of the functional connectivity of the core area. If the migratory life form was absent from core area, or if the migratory form is present but local populations lack connectivity, the core area was considered to be at increased risk. If the migratory life form persists in at least some local populations, with partial ability to connect with other local populations, the core area was judged to be at intermediate risk. Finally, if the migratory life form was present in all or nearly all local populations, and had the ability to connect with other local populations, the core area was considered to be at diminished risk.

Lack of passage at Bureau of Reclamation facilities within the Middle Columbia Recovery Unit has fragmented bull trout populations and prevented migration to foraging and overwintering habitat. Migratory bull trout persist at low numbers within most of the local populations within the Middle Columbia Recovery Unit. Lack of passage and the low abundance of the migratory life history strategy also limits the possibility for genetic exchange and local population reestablishment. Even though the migratory form persists in the Yakima Core Area, the Middle Columbia Recovery Unit Team considered bull trout in the core area to be at increased risk since local populations lack connectivity.

Recovery Criteria

Recovery criteria for bull trout in the Middle Columbia Recovery Unit are:

1) **Bull trout are distributed among 16 local populations in the Yakima Core Area.** Local populations that are considered essential for recovery include: Ahtanum (including North, South, and Middle forks rivers), Upper Yakima River mainstem (Keechelus to Easton), Rattlesnake Creek, North Fork Teanaway River, Upper Cle Elum River, American River, Crow Creek, South Fork Tieton River, North Fork Tieton River, Indian Creek, Deep Creek, Box Canyon Creek, Upper Kachess River (including Mineral Creek), Gold Creek, Middle Fork Teanaway, Taneum Creek. The recovered distribution for the Yakima Core Area places it at a diminished risk from stochastic events.

2) **Estimated abundance of bull trout among all local populations in the Yakima Core Area is between 2,550 to 3,050 migratory adults.** The recovered abundance criteria was derived by using the professional judgement of the Middle Columbia Recovery Unit Team to estimate the productive capacity of identified local populations. Adult abundance estimates for individual local populations are: Gold Creek (200 adults); Box Canyon Creek (100 adults); Upper Kachess River (100 adults); Indian Creek (500 adults); South Fork Tieton River (500 adults); Deep Creek (300 adults); American River including Union and Kettle creeks (200 to 500 adults); Rattlesnake including Little Wildcat Creek (200 to 400 adults); Crow Creek (150 adults); Ahtanum Creek including the North, South, and Middle forks (300 adults). Recovered abundance levels do not include estimates for local populations in the Upper Yakima River mainstem (Keechelus to Easton), North Fork Teanaway River, Middle Fork Teanaway River, North Fork Tieton River, Taneum Creek, and the Upper Cle Elum River. Estimates for these six migratory local populations, as well as the resident life history component, are considered research needs. The established recovered abundance levels assume that threats (including fragmentation of local populations) have been addressed and that the Yakima Core Area is a functioning metapopulation. While the recovered abundance for the Yakima Core Area falls short of long-term idealized estimates for effective population size (Chapter 1), the

Middle Columbia Recovery Team feels that the estimated range accurately reflects an achievable recovered abundance level. The identified recovered abundance levels should prevent inbreeding depression and minimize the loss of genetic variation due to genetic drift. The identified abundance levels relative to the maintenance of long-term genetic variation which would provide the population the ability to adapt to natural selection and changing environmental conditions will be evaluated.

3) **Adult bull trout exhibit a stable or increasing trend for at least two generations at or above the recovered abundance level within core areas.** The development of a standardized monitoring and evaluation program which would accurately describe trends in bull trout abundance is identified as a priority research need. As part of the overall recovery effort, the U.S. Fish and Wildlife Service will take the lead in addressing this research need by forming a multi-agency technical team to develop protocols to evaluate trends in bull trout populations.

4) Specific barriers to bull trout migration in the Yakima Core Area have been addressed. The Middle Columbia Recovery Team believes that to reduce the threat from population fragmentation, and for recovery to occur, the migratory life history form needs to be present in all or nearly all local populations with the ability to connect with other local populations. The barriers that are identified as primary impediments to recovery and which must be addressed are: Tieton Dam (Rimrock Lake), Bumping Lake Dam, Keechelus Dam, Cle Elum Dam, Kachess Dam. Identification of these barriers does not imply that other actions associated with passage (*e.g.*, culverts), habitat degradation, or nonnative species control are not crucial for recovery to occur.

The Middle Columbia Recovery Unit Team expects the recovery process to be dynamic and plans refined as more information becomes available. While removal of bull trout as a species under the Endangered Species Act (*i.e.*, delisting) can only occur for the entity that was listed (Columbia River Distinct

Population Segment), the criteria listed above will be used to determine when the Middle Columbia Recovery Unit is fully contributing to recovery of the population segment.

Research Needs

Based on the best scientific information available, the team has identified recovery criteria, and actions necessary for recovery of bull trout, within the recovery unit. However, the recovery unit team recognizes that uncertainties exist regarding bull trout population abundance, distribution, and actions needed. The recovery team believes that if effective management and recovery are to occur, the recovery plan for the Middle Columbia Recovery Unit be viewed as a "living" document, which will be updated as new information becomes available. As part of this adaptive management approach, the recovery unit team has identified research needs that are essential within the recovery unit.

Columbia River and Tributaries

A primary research need is a complete understanding of the current and future role that the mainstem Columbia River should play in the recovery of bull trout. It is likely that fluvial bull trout within the basin historically migrated to the Columbia River to overwinter and feed. Uncertainty in the current use of the mainstem Columbia River by fluvial bull trout within the recovery unit has led the recovery team to identify the Columbia River as a research need. Given that bull trout have recently been found at several mainstem facilities (*i.e.*, Rock Island, Rocky Reach, and Wells), a better understanding of migration patterns between basins would greatly enhance the opportunities for recovery. The recovery team believes that migrational studies for the Middle Columbia Recovery Unit should be coordinated with the Upper Columbia Recovery Unit in order to provide a more complete understanding of adult bull trout habitat requirements.

Similarly, additional studies are needed in the lower Yakima River in order to better understand current use and identify additional limiting factors, which may negatively impact adult, or subadult bull trout. The recovery team believes that coordination of this effort with investigations of mainstem Columbia

River under the Biological Opinion on the "Effects to Listed Species from Operation of the Federal Columbia River Power System" (USFWS 2000) is appropriate. Studies such as tagging adult bull trout at Rosa Dam and monitoring seasonal migrations within the Yakima basin, or into the Columbia River, would be valuable.

Additional survey work is needed in tributaries to the Yakima River in order to better understand the current and potential distribution within the basin. Specific areas within the basin where distribution surveys should focus include the North and Middle Fork Teanaway River, Cle Elum River, American River, North Fork Tieton River, Little Naches River, Oak Creek, Taneum River, Big Creek, Nile Creek, and the mainstem Yakima River between Easton Lake, and Keechelus Lake.

Monitoring and Evaluation

Recovery criteria will most likely be revised as recovery actions are implemented and bull trout populations begin to respond. In addition, adaptive management will be used to better refine both abundance and distribution criteria. Adaptive management involves a continuing process of planning, monitoring, evaluating management actions, and research. This approach will involve a broad spectrum of user groups and will lay the framework for decision making relative to recovery implementation and ultimately, the possible revision of recovery criteria in this recovery unit.

This recovery unit chapter is the first step in the planning process for bull trout recovery in Middle Columbia Recovery Unit. Monitoring and evaluation of population levels and distribution will be an important component of any adaptive management approach. The U.S. Fish and Wildlife Service will take the lead in developing a comprehensive monitoring approach, which will provide guidance and consistency in evaluating bull trout populations. Development and application of models, which assess extinction risk relative to abundance and distribution parameters are critical in refining recovery criteria as the recovery process proceeds.

Artificial Propagation

The Middle Columbia Recovery Unit Team has identified that in order to reach a recovered condition within the Yakima Core Area within 25 years may require the use of artificial propagation. Artificial propagation could involve the transfer of bull trout into unoccupied habitat within the historic range (ODFW 1997). In addition, artificial propagation could involve the use of Federal or State hatcheries to assist in recovery efforts (Montana Bull Trout Scientific Group (MBTSG) 1996). The Middle Columbia Recovery Team recommends that studies be initiated to determine the effectiveness and feasibility of using artificial propagation in bull trout recovery.

Any artificial propagation program instituted in the Middle Columbia Recovery Unit must follow the joint policy of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding controlled propagation of listed species (65 FR 56916). The overall guidance of the policy is that every effort should be made to recover a species in the wild before implementing a controlled propagation program. If necessary, an appropriate plan would need to be approved that considers the effects of transplantation on other species as well as the donor bull trout populations. Transplanting listed species must be authorized by the U.S. Fish and Wildlife Service and meet applicable Federal and State fish-handling and disease policies.

The overall recovery strategy for bull trout in the Middle Columbia Recovery Unit will emphasize identifying and correcting threats affecting bull trout and bull trout habitats. Artificial propagation programs should not be implemented unless reasons for decline have been addressed.

Genetic Studies

The Middle Columbia Recovery Unit Team recommends that studies be initiated to describe the genetic makeup of bull trout in the Yakima Core Area. Genetic information on local populations within the core area is necessary for a more complete understanding of bull trout interactions and population dynamics. In addition, a recovery unit wide evaluation of the current and potential threat of

bull trout hybridization with brook trout is needed. The ability to evaluate the potential harm to specific local populations could be used in prioritizing management actions. Genetic baseline information would also be a necessity in the implementation of any artificial propagation program.

ACTIONS NEEDED

Recovery Measures Narrative

In this chapter and all other chapters of the bull trout recovery plan, the recovery measures narrative consists of a hierarchical listing of actions that follow a standard template. The first-tier entries are identical in all chapters and represent general recovery tasks under which specific (*e.g.*, third-tier) tasks appear when appropriate. Second-tier entries also represent general recovery tasks under which specific tasks appear. For a complete and thorough discussion of second-tier tasks, see Chapter 1. Second-tier tasks that do not include specific third-tier actions are either programmatic activities that are applicable across the species' range and appear in *italicized font* or are tasks that may not be sufficiently developed to apply to the recovery unit at this time and appear in *an italicized shaded font (as seen here)*. These tasks are included to preserve consistency in numbering tasks among recovery unit chapters and intended to assist in generating information during the comment period for the draft recovery plan, a period during which additional tasks may be developed. Third-tier entries are tasks specific to the Middle Columbia Recovery Unit. They appear in the implementation schedule that follows this section and are identified by three numerals separated by periods.

The Middle Columbia Recovery Unit Chapter should be updated or revised as recovery tasks are accomplished, environmental conditions change, or monitoring results or other new information becomes available. Revisions to the Middle Columbia Recovery Unit Chapter will likely focus on priority streams or stream segments within core areas where restoration activities occurred, and habitat or bull trout populations have shown a positive response. The Middle Columbia Recovery Unit Team should meet annually to review annual monitoring reports and summaries, and make recommendations to the U.S. Fish and Wildlife Service to revise the Middle Columbia Recovery Unit Chapter.

1 Protect, restore, and maintain suitable habitat conditions for bull trout.

1.1 Maintain or improve water quality in bull trout core areas or potential core habitat.

1.1.1 **Reduce mining runoff.** Reduce mining runoff by removing and/or stabilizing mine tailings in the Little Naches River, Swauk Creek, and Morse Creek.

1.1.2 **Reduce sediment inputs.** Reduce sediment loading from irrigation return flow and nonpoint source runoff in the Yakima Core Area (*e.g.*, Tieton River and lower Naches River) .

1.1.3 **Assess development.** Assess effects of residential and shoreline/floodplain development in known bull trout habitat and ensure compliance with State, county, and Tribal land management growth plans (*e.g.*, Lower Little Creek, Naches River).

1.2 Identify barriers or sites of entrainment for bull trout and implement tasks to provide passage and eliminate entrainment.

1.2.1 **Screen diversions.** Screen all water diversions and irrigation ditches in the Yakima Core Area. Specific areas of concern include: lower North Fork Ahtanum Creek and in the mainstem Ahtanum Creek between John-Cox Ditch and the upper Wapato Irrigation Project Diversion; and the Teanaway River to reduce stranding in irrigation canals (*i.e.*, Coleman and Wilson creek drainages).

1.2.2 **Diversion operations.** Ensure that existing screened diversions operate properly and do not create passage barriers.

1.2.3 **Irrigation withdrawal.** Evaluate impacts of irrigation withdrawal on bull trout passage within the Yakima Core Area and recommend appropriate instream flows. Specific areas of concern include: Lower Rattlesnake Creek; Big Creek; Lower Taneum Creek; Teanaway River; Gold Creek (Keechelus Lake); and Ahtanum Creek below River kilometer 32 (River Mile 19.7).

1.3 Identify impaired stream channel and riparian areas and implement tasks to restore their appropriate functions.

1.3.1 **Livestock and ungulate damage.** Develop and implement adaptive management plans which include performance standards and targets that grazing practices must meet and will ensure adequate habitat and water quality conditions for bull trout recovery. Plans should address livestock exclusion from sensitive bull trout areas (*e.g.*, spawning grounds in August and September). Specific areas of concern include: Teanaway River (*e.g.,* Indian, Middle and Jungle Creeks, West Fork Teanaway); Ahtanum Creek (*e.g.*, Tree Phones grazing allotment on Middle Fork, headwaters of South Fork, North Fork Rivers and Shellneck Creek); Taneum Creek (lower mainstem); South Fork Tieton River (*e.g.*, Conrad Meadows, Minnie Meadows outside exclosure); and the lower Tieton River (*e.g.*, Fish Creek, Milk

Creek, Cabin Creek, Wildcat Creek, Thunder Creek).

1.3.2 **Evaluate timber harvest regulations.** Evaluate existing regulations and monitor effectiveness of timber harvest regulations and minimum riparian buffers to improve stream function in all bull trout watersheds. Where existing regulations are found to be inadequate, adopt changes in protection measures that will lead to properly functioning conditions. Specific areas of concern due to past and current forest management practices include: Ahtanum Creek; Oak Creek; South Fork Tieton River and other lower Tieton River tributaries; Lower Rattlesnake Creek and Little Rattlesnake Creek (low to moderate); Nile Creek; Rock Creek; Milk Creek; Little Naches River; Taneum Creek; Little Creek; Big Creek; Lower Gold Creek; Mineral Creek, Box Canyon Creek; Gale Creek; Cle Elum River tributaries below the wilderness area; Teanaway River below the wilderness area; Swauk Creek; and Taneum Creek.

1.3.3 **Repair roads and culverts.** Identify and repair, or remove, or relocate roads and culverts that; are susceptible to mass wasting and bank failures, negatively impact riparian areas, and inhibit connectivity and natural stream functions in all bull trout watersheds. Specific areas of concern include: Forest Service 1900 Road along the lower Little Naches River; Forest Service 1501 Road along Little Rattlesnake Creek; Forest Service 620 Road crossing on Three Creeks, tributary to Rattlesnake Creek; North Fork Ahtanum road near Shellneck

Creek; Shellneck Creek Road; Upper South Fork Ahtanum Road; Forest Service roads 9738 and 9701, Indian Creek Road, Middle Creek Road, Dickey Creek Road, Lick Creek Road, Carlson Creek Road, Dingbat Creek Road, and Sandstone Creek Road in the Teanaway Watershed; Forest Service Road 152 in the Big Creek drainage; and Forest Service roads 140, 41, and 4110 in the Cabin Creek drainage.

1.3.4 **Address road access impacts.** Address road access impacts for roads that increase the risk of poaching and fishing pressure, especially in bull trout spawning and staging areas.

1.3.5 **Minimize mining impacts.** All mining activities should be conducted to minimize impacts to bull trout and their habitat and must comply with the Washington State Hydraulic Code. Specific recommendations for mining activities include: mining activities should not be conducted during spawning, egg incubation, or prior to fry emergence; mining activities should only be conducted within the ordinary high water mark of the stream; mining activities should not disturb stream channel banks or riparian vegetation; depressions created by mining activities must be refilled immediately after operations are completed; suction hoses shall be adequately sized and screened to prevent juvenile fish from being injured; mining equipment will be inspected and maintained in a manner that prevents leaking of fuels and contaminants from entering waters; all fuels and other contaminants will be stored away

from the stream and in a manner that will prevent entry into waters; and monitoring will be conducted to determine the effectiveness of regulations and recovery actions to provide desired habitat and water quality conditions.

1.3.6 **Manage camping.** Manage dispersed and developed camping site to avoid impacts to bull trout spawning and rearing habitat (*e.g.*, South Fork Tieton).

1.3.7 **Road management.** Evaluate compliance with existing management plans, or develop new strategies, to identify, repair, or remove roads to enhance connectivity, reduce road density, and restore habitat and floodplain function.

1.3.8 **Develop habitat guidelines.** Develop and implement guidelines for bull trout that restore or maintain habitat elements (*e.g.*, sediment delivery, water temperature, normative hydrologic function) to provide for recovery.

1.4 Operate dams to minimize negative effects on bull trout in reservoirs and downstream.

1.4.1 **Fish passage.** Develop options and recommend appropriate designs for fish passage at Keechelus, Kachess, Cle Elum, Bumping, and Rimrock dams.

1.4.2 **Reduce entrainment.** Investigate alternative means to reduce or eliminate the possibility of entrainment losses in the outlet works of all of the storage dams.

1.4.3 **Water temperature control.** Assess the usefulness, cost, and feasibility of modifying the outlet works of all of the storage dams to provide enhanced water temperature control.

1.4.4 **Flow regimes.** Evaluate U.S. Bureau of Reclamation and irrigation district operations and recommend alternatives for establishing more normative flow regimes in the Yakima Core Area.

1.4.5 **Reservoir operations.** Evaluate reservoir operations as they relate to water level manipulations and provide recommendations to insure successful passage, to and from natal streams, for adfluvial bull trout populations.

1.4.6 **Reservoir investigations.** Collect and analyze physical, chemical, and biological information on reservoirs in the Yakima Core Area relative to bull trout requirements.

1.5 Identify upland conditions negatively affecting bull trout habitats and implement tasks to restore appropriate functions.

2 Prevent and reduce negative effects of nonnative fishes and other nonnative taxa on bull trout.

2.1 Develop, implement, and evaluate enforcement of public and private fish stocking policies to reduce stocking of nonnative fishes that affect bull trout.

2.2 Evaluate enforcement of policies for preventing illegal transport and introduction of nonnative fishes.

2.3 Provide information to the public about ecosystem concerns of illegal introductions of nonnative fishes.

2.4 Evaluate biological, economic, and social effects of control of nonnative fishes.

2.5 Implement control of nonnative fishes where found to be feasible and appropriate.

2.5.1 **Nonnative harvest.** Develop, maintain, and support liberal year-round bag limits on nonnative predators in Yakima Core Area (*e.g.*, lake trout, brown trout).

2.5.2 **Eliminate stocking.** While brook trout are no longer directly stocked into bull trout waters, the prohibition of stocking of brook trout should be expanded to include in the entire Yakima Core Area to prevent the possibility of volitional range expansion.

2.5.3 **Reduce nonnative species.** Reduce numbers and distribution of brook and brown trout populations in the Yakima Core Area.

2.5.4 **Assess stocking practices.** Assess the impacts of current rainbow trout stocking practices in the Tieton River and Wide Hollow Creek.

2.6 Develop tasks to reduce negative effects of nonnative taxa on bull trout.

3 Establish fisheries management goals and objectives compatible with bull trout recovery, and implement practices to achieve goals.

3.1 Develop and implement State and Tribal native fish management plans integrating adaptive research.

3.2 Evaluate and prevent overharvest and incidental angling mortality of bull trout.

3.2.1 **Harvest regulations.** Evaluate compliance with harvest regulations and policies and target bull trout spawning and staging areas for enforcement.

3.2.2 **Reduce fishing pressure**. Reduce angler pressure in areas where incidental mortality continues to be detrimental to recovery. Utilize innovative techniques such as seasonal or permanent road closures and establishment of conservative regulations or fisheries management policies for other fisheries whose popularity may result in increased bull trout by-catch.

3.2.3 **Provide information to anglers.** Provide outreach and educational material to anglers on bull trout identification, special regulations, and methods to reduce hooking mortality of bull trout caught incidentally in recreational fisheries.

3.3 Evaluate potential effects of introduced fishes and associated sport fisheries on bull trout recovery and implement tasks to minimize negative effects on bull trout.

3.4 Evaluate effects of existing and proposed sport fishing regulations on bull trout.

4 Characterize, conserve, and monitor genetic diversity and gene flow among local populations of bull trout.

4.1 Incorporate conservation of genetic and phenotypic attributes of bull trout into recovery and management plans.

4.1.1 **Develop genetic management plan.** Develop genetic management plan for reconnecting isolated populations in the Yakima Core Area including establishment of genetic baselines for each local population, monitoring genetic changes in existing local populations, evaluation of hybridization with brook trout, presence of effects of viable F2 hybrids, and identification of actions needed to maintain existing opportunities for gene flow among bull trout populations.

4.2 Develop genetic management plans and guidelines for appropriate use of transplantation and artificial propagation.

4.2.1 **Artificial Propagation.** Reestablishment of local populations within the Yakima Core Area may require the use of artificial propagation. The Middle Columbia Recovery Team recommends that studies be initiated to determine the effectiveness and feasibility of using fish transfers and hatcheries to assist in any future reintroduction efforts.

5 Conduct research and monitoring to implement and evaluate bull trout recovery activities, consistent with an adaptive management approach using feedback from implemented, site-specific recovery tasks.

5.1 Design and implement a standardized monitoring program to assess the effectiveness of recovery efforts affecting bull trout and their habitats.

5.1.1 **Habitat assessments.** Identify site-specific threats that are negatively effecting on the suitability of bull trout habitats used for spawning, rearing (adult and juvenile), migrating, and overwintering

5.2 Conduct research evaluating relationships among bull trout distribution and abundance, bull trout habitat, and recovery tasks.

5.2.1 **Monitoring program.** Develop and implement a monitoring program to evaluate effectiveness of recovery actions.

5.3 Conduct evaluations of the adequacy and effectiveness of current and past Best Management Practices in maintaining or achieving habitat conditions conducive to bull trout recovery.

5.4 Evaluate effects of diseases and parasites on bull trout, and develop and implement strategies to minimize negative effects.

5.5 Develop and conduct research and monitoring studies to improve information concerning the distribution and status of bull trout.

5.5.1 **Distribution surveys.** Conduct intensive distribution surveys in the North and Middle Fork Teanaway River, Cle Elum River, American River, North Fork Tieton River, Little Naches River, Oak Creek, Taneum River, Big Creek, Nile Creek and Yakima River between Easton and Keechelus Lakes.

5.5.2 **Predation.** Evaluate site-specific impacts of predation on different life stages of bull trout.

5.5.3 **Habitat use.** Determine movement and seasonality of use of different habitat types of adult and subadult migratory bull trout with specific emphasis on the mainstem Yakima and Columbia Rivers.

5.5.4 **Problem Assessments.** Conduct problem assessments for bull trout and identify site-specific threats that may be limiting recovery efforts. Coordinate with Water Resource Inventory Areas and the Northwest Power Planning Council's Subbasin Planning process to fill "data gaps".

5.6 Identify evaluations needed to improve understanding of relationships among genetic characteristics, phenotypic traits, and local populations of bull trout.

6 Use all available conservation programs and regulations to protect and conserve bull trout and their habitats.

6.1 Use partnerships and collaborative processes to protect, maintain, and restore a functioning core area for bull trout.

6.1.1 **Support collaborative efforts.** Where bull trout status is known, support collaborative efforts by local watershed groups and conservation districts to accomplish site specific restoration.

6.1.2 **Habitat protection.** Where bull trout status is known, provide long term habitat protection through purchase, conservation easements, management plans, etc.

6.1.3 **Watershed groups and landowners.** Work with, and support, local watershed groups, conservation districts, and private landowners to assess bull trout status, identify actions needed, and implement recovery activities.

6.2 Use existing Federal authorities to conserve and restore bull trout.

6.3 Evaluate enforcement of existing Federal and State habitat protection standards and regulations and their effectiveness for bull trout conservation.

7 Assess the implementation of bull trout recovery by recovery units, and revise recovery unit plans based on evaluations.

7.1 Convene annual meetings of each recovery unit team to generate progress reports on implementation of the recovery plan for the U.S. Fish and Wildlife Service.

7.2 Develop and implement a standardized monitoring program to evaluate the effectiveness of recovery efforts (coordinate with 5.1).

7.3 Revise scope of recovery as suggested by new information.

7.3.1 **Periodically review progress towards recovery goals and assess recovery task priorities.** Annually review progress toward population and adult abundance criteria and recommend changes, as needed, to the Middle Columbia Recovery Unit Chapter. In addition, review tasks, task priorities, completed tasks, budget, time-frames, particular successes, and feasibility within the Middle Columbia Recovery Unit.